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Pertussis

Introduced in 1952/3 (DTP) DTaP introduced 1996

NOTIFIABLE

Introduction

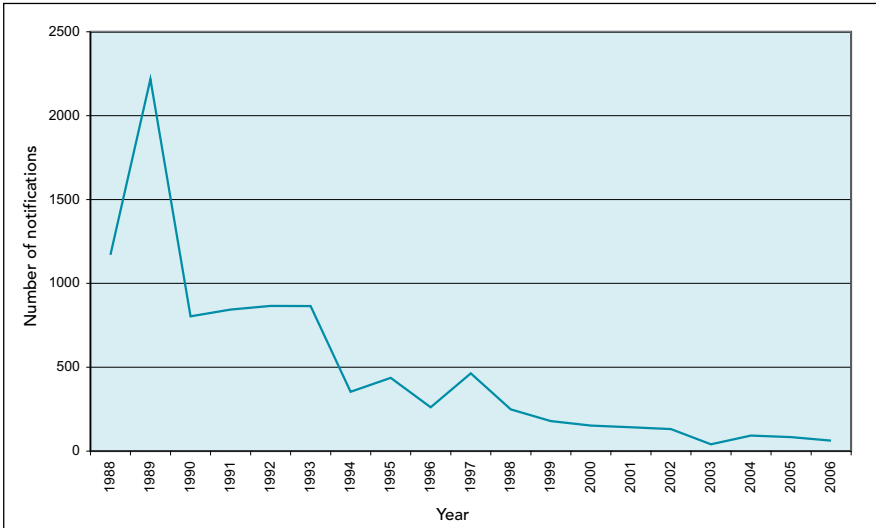
Pertussis (whooping cough) is a highly infectious bacterial disease caused by *Bordetella pertussis*, a fastidious gram-negative coccobacillus. Following infection or immunisation immunity wanes over 1-2 decades. Subsequent infection tends to be milder, may not be diagnosed, but is infectious. Approximately 16 secondary infections will result from each index case in a fully susceptible population.

Epidemiology

Pertussis occurs endemically with periodic outbreaks. Worldwide, over 45 million cases occur annually, with more than 250,000 deaths. Epidemiological data on pertussis in the Republic of Ireland have been gathered annually since 1941. There has been a steady decline in mortality which commenced before the introduction of the vaccine, but the rate of decline accelerated following its introduction.

Prior to the introduction of vaccination most cases occurred in young children. Now the highest incidence, morbidity and mortality are in infants. More cases have recently been occurring in adolescents and adults. This change in the epidemiology of pertussis is due to the waning immunity that occurs after both disease and vaccination, and to a reduction in natural boosting. Thirty per cent of adults with a cough lasting longer than 2 weeks may have pertussis. Most infants and young children who contract pertussis are infected by a family member.

Figure 11.1 Number of pertussis notifications in Ireland, 1988-2006.
Source: HPSC



The large increase in notifications of pertussis that occurred in the 1980s followed a scare in the late 1970s regarding a possible association of the vaccine and encephalopathy, which led to low-vaccine uptake (see Figure 11.1).

Humans are the only known hosts of *B. pertussis*. Transmission occurs by close contact via droplet infection from the respiratory tract of symptomatic individuals. The incubation period is 7-10 days (range 4-21). As many as 90% of non-immune household contacts acquire the infection. Communicability is greatest in the catarrhal stage before the onset of paroxysms of coughing, but may last for up to 3 weeks. Macrolide antibiotics decrease infectivity and may limit secondary spread if given early in the course of the infection in those aged over 6 months. They have no effect on the course of the illness if given after the cough is established.

Effects of pertussis

Pertussis is primarily a toxin-mediated disease. Bacteria attach to the respiratory cilia and produce toxins which paralyse the cilia. This, and inflammation, interfere with the clearing of secretions. Many factors determine disease severity, including age of the patient and time since vaccination or previous infection.

The initial catarrhal stage has an insidious onset and is the most infectious period. Cough is limited, the main symptom being rhinorrhoea. An

irritating cough gradually becomes paroxysmal, with a characteristic inspiratory whoop and/or vomiting in about 50% of cases. This paroxysmal stage usually occurs within 1-2 weeks, and often lasts for 2-3 months. In young infants, the typical 'whoop' may never develop and coughing spasms may be followed by periods of apnoea and cyanosis.

Pertussis may be complicated by bronchopneumonia (in 22% of infants) and by cerebral hypoxia with resulting risk of seizures (3% of infants, more in those less than 6 months), and encephalopathy. These complications and deaths occur most commonly in infants under 6 months of age. The highest mortality rate is in preterm infants. The case-fatality rate ranges from 0.04-4%.

Among adolescents and adults the only symptom may be a prolonged cough. This lasts for at least 3 weeks in over 80%, and for up to 90 days in over 25% of cases.

Diagnosis on clinical grounds can be difficult. The organism can be grown on selective media, with incubation for 10-14 days. This requires rapid and careful transport of a nasopharyngeal aspirate or swab in an appropriate medium. Cultures cannot be considered negative until after 10 days. Cultures are less likely to be positive if the person has been immunised, if antibiotics have been taken, or if cough has been present for more than 2 weeks.

PCR, ELISA within 1 week of symptom onset and 4-6 weeks later, and direct fluorescent antibody testing can aid diagnosis.

Treatment

If treatment is begun within 3 weeks of onset of symptoms it can limit transmission, and may reduce the duration of the disease if started in the catarrhal stage. Prophylaxis is recommended for vulnerable household contacts. These may be defined as those who live in the same house or stayed overnight in the same room as the index case, and are under 5 years of age and unimmunised or partially immunised, or have congenital heart disease or severe asthma, or are immunocompromised

Suggested antibiotic prophylactic regimes:

1. Erythromycin, 20-25 mg/kg BD (max 2g per dose) for 7 days is effective in preventing culture positive pertussis in 67% of household contacts, but may have limited clinical impact
2. Clarithromycin, 10 mg/kg BD (max 500 mg/dose) for 7 days
3. Azithromycin, 10 mg/kg once daily (max 500 mg per dose) for 5 days.

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Erythromycin has been associated with pyloric stenosis in those aged under 1 month, but the risks of pertussis are far greater than the risks from erythromycin in this age group. There are no large-scale trials of either Clarithromycin or Azithromycin in this situation.

Pertussis vaccine

This is no longer available as a single vaccine. Pertussis vaccines contain purified acellular pertussis antigens, which cause significantly less local and systemic reactions than whole-cell vaccines. Antigens differ between vaccines but usually include inactive pertussis toxin, filamentous haemagglutinin and pertactin.

The vaccine should be stored between 2-8°C. If the vaccine has been frozen, it should not be used.

A full course of vaccine confers protection in over 80% of recipients. Immunity wanes with age, and is low or absent 10-12 years after primary immunisation. High vaccine uptake rates, including booster doses, are therefore very important in order to reduce the incidence of pertussis. In those not fully protected the disease is usually less severe.

Dose and route of administration

The dose is 0.5 ml, given by intramuscular injection into the anterolateral thigh or deltoid.

Indications

The primary course consists of 3 doses given at 2, 4 and 6 months, with a booster at 4-5 years. A further booster, using Tdap which contains low-dose acellular pertussis vaccine, is recommended at 11-14 years. If the primary course is interrupted it should be resumed but not repeated, allowing appropriate intervals between the remaining doses.

If pertussis vaccine is refused by parents, the only available diphtheria and tetanus vaccines are Td and Td/IPV. They are not intended for use as part of the primary schedule, may not give a sufficient immune response if so used, and are not licensed for such use.

Pertussis vaccination should be considered for children aged less than 10 years who are exposed to pertussis, if they have received less than 4 doses of the vaccine. Children may be given dose four at as early as 12 months of age, preferably 6 months after dose three (for catch-up doses, see Chapter 2).

Contraindications

Anaphylaxis to a previous pertussis-containing vaccine or to one of its constituents.

Precautions

Acute severe febrile illness; defer until recovery.

Note; The following are no longer regarded either as contraindications or precautions. They have not been shown to cause permanent harm and are significantly less common after acellular than after whole-cell vaccines

- 1 Temperature of more than 40.5°C within 48 hours of a previous dose of a pertussis-containing vaccine
- 2 Hypotonic-hyporesponsive episode within 48 hours of a previous dose of a pertussis-containing vaccine
- 3 Seizures within 72 hours of a previous dose of a pertussis-containing vaccine
- 4 Persistent, inconsolable crying lasting more than 3 hrs within 48 hours of a previous dose of a pertussis-containing vaccine

Adverse reactions

Local: Minor side-effects (e.g. local redness, swelling) occur in about 15-20% of recipients. Very rarely a major local reaction involving swelling and erythema of most of the diameter of a limb can occur. This resolves without sequelae, and is not a contraindication to further vaccination.

General: Fever and irritability can occur. However, temperature over 40°C is rare. Serious side-effects such as prolonged, inconsolable crying or hypotonic-hyporesponsive episodes are very rare and have not been shown to cause long-term problems. Administration of paracetamol or ibuprofen at the time of immunisation may reduce the incidence of local and febrile reactions.

Bibliography

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Department of Health UK (2006). Immunisation against infectious disease (the Green Book). 3rd ed. London: The Stationery Office.